**REMARKS**

In section 1 of the Office Action, the Examiner rejected claim 12 under 35 U.S.C. §103(a) as being unpatentable over the Friesen patent.

The Friesen patent discloses, in Figure 2, a mixer 10 having an input 11, input 12, an output 15, baluns 16 and 17, and a mixer element 19. An RF input signal 14 is received at the input 12. The balun 16 splits the RF input signal 14 into two signals 18 and 20 that are supplied to the mixer element 19. A local oscillator signal 13 is received at the input 11 and is supplied to the balun 17. The balun 17 splits the local oscillator signal 13 into signals 21 and 22 that are supplied to the mixer element 19. The mixer element 19 mixes the signals 18, 20, 21, and 22 to produce an IF signal at the output 15.

As shown in Figure 3, a double balanced mixer 130 has phase shifters 150 and 160, a power divider 170, a mixing element 145, an RF input 151, a local oscillator input 161, and an IF output 171. The phase shifter 150 phase shifts the RF signal received on the RF input 151 by $180^0$. The phase shifter 160 phase shifts the local oscillator signal received on the local oscillator input 151 by $180^0$. The outputs of the phase shifters 150 and

160 are coupled to the mixing element 145. The IF signal pairs generated in the mixing element 145 are coupled to the power divider 170 where they are combined to form a composite IF output signal coupled to the IF output 171.

As shown in Figure 5, a double balanced mixer 30 has phase shifters 50 and 60, a power divider 70, a mixing element 45, an RF signal input 51, a local oscillator signal input 61, and an IF signal output 71. The mixer 30 operates similarly to the mixer 130 with the phase shifters 50 and 60 corresponding to the phase shifters 150 and 160, the power divider 70 corresponding to the power divider 170, and the mixing element 45 corresponding to the mixing element 145. The mixer 30 also includes impedance matching circuitry 90 and 90' and 80 and 80'.

The phase shifter 50 has a coupler 54, a capacitor 57, and transmission lines 56 and 58. The coupler 54 provides equal amplitude signals, which have a relative phase difference of $90^0$, to the transmission line 56 and the capacitor 57. The transmission lines 56 and 58 and the capacitor 57 provide an additional $90^0$ of phase shift to signals from the coupler 54. The transmission lines 56 and 58 are fabricated in planar and monolithic integrated circuit form. The length of the transmission

line 56 is one half-wavelength of the RF center frequency.

The phase shifter 60 is similarly constructed. However, the length of transmission line 58 is one quarter-wavelength of the RF center frequency.

The mixing element 45 is a quad of diodes operated in a non-linear mode. According to the Friesen patent, field effect transistors operated in a non-linear mode are also suitable for use in the mixing element 45. Due to the non-linear conduction properties of the mixing element 45, the local oscillator and RF signals are mixed, resulting in the generation of the IF signal pairs.

The IF signal pairs are coupled to the power divider 70, which combines the IF signal pairs to produce a composite IF signal coupled to the IF output 71.

The Friesen patent states that the mixer 30 is fabricated on a single MMIC die.

Independent claim 12 requires a printed output circuit (i) having a wideband RF response, (ii) producing a narrow band IF output signal, and (iii) including a printed circuit balun.

The Friesen patent does not disclose or suggest such a printed output circuit.

Accordingly, independent claim 12 is not unpatentable over the Friesen patent.

Independent claim 13 was indicated as being allowable by the Examiner in its dependent form.

New dependent claim 21 specifies that the printed balun of independent claim 12 has first and second foil elements, that the first foil element is coupled to the switching circuit and to the RF signal source, and that the second foil element is displaced from the first foil element and produces the IF output signal.

The Friesen patent does not disclose or suggest such a printed balun.

Accordingly, dependent claim 21 is not unpatentable over the Friesen patent.

New independent claim 22 requires a printed output circuit that (i) has a wideband RF response, (ii) produces a narrow band IF output signal, and (iii) includes a balun having an input balun element and an output balun element such that the input balun element is coupled to the switching circuit and to the RF signal input and such that the output balun element is coupled to the IF output.

The Friesen patent does not disclose or suggest such a printed output circuit.

Accordingly, independent claim 22 is not unpatentable over the Friesen patent.

In section 2 of the Office Action, the Examiner rejected claims 12, 14, and 15 under 35 U.S.C. §103(a) as being unpatentable over the Andrys patent.

The Andrys patent discloses that an incoming signal is received at 1.9 GHz, is amplified, band pass filtered, and is converted to an intermediate frequency of 250 MHz by application of a local oscillator frequency of 1650 MHz. The IF signal is amplified and combined and routed by a switch that allows a band pass filter channel filter to be shared in both the transmit and receive modes.

Figure 1 of the Andrys patent shows an RF downconverter having an RF balun 2 and a mixer 4. The RF balun 2 includes amplifiers 10 and 12 sharing a common input 14 receiving an RF signal. A bias circuit 6 provides gate bias for the amplifiers 10 and 12.

The active mixer 4 preferably uses four FETs 30, 32, 34, and 36 connected in a commutating ring. The gates of the FETs receive the local oscillator signal through an amplifier 38 and through parallel resonant LC

tank circuits 40 and 42 that provide a high in-band impedance and a low out-of-band impedance to the outputs of the amplifier 38 and that attenuate noise from the amplifier 38. The IF outputs IFN and IFP have corresponding traps 54 and 56 to prevent degradation of mixer gain and noise figure.

Admitting that the Andrys does not specifically disclose an output circuit that has a wideband RF response and that produces a narrow band IF output signal, the Examiner opines that, because of the elements 50, 52, 54, and 56 and because the Andrys patent mentions narrowing of the IF bandwidth, it would have been obvious that the elements 50, 52, 54, and 56 have a wideband RF response and produce a narrow band IF output signal.

However, the narrowing of the IF bandwidth referred to by the Examiner is described in the Andrys patent as a bad thing. Specifically, the Andrys patent states that a high impedance (presumably at each IF output IFN and IFP) is desirable for maximum voltage gain, but can result in a narrowing of the IF bandwidth. Thus, the Andrys patent implies that narrowing the IF bandwidth is undesirable and, thereby, implicitly suggests that measures should be taken to achieve maximum voltage gain without narrowing the IF bandwidth.

Therefore, the Andrys patent teaches away from the inventions of independent claims 12, 13, and 22.

Moreover, stating that the IF bandwidth is narrowed is not a disclosure that the IF bandwidth is narrow. Indeed, the Andrys patent simply does not disclose that the IF bandwidth is narrow. Therefore, the Andrys patent does not teach the inventions of independent claims 12, 13, and 22.

Furthermore, as the Examiner has noticed, the Andrys patent does not disclose any RF or IF bandwidth that would suggest the inventions of independent claims 12, 13, and 22.

Accordingly, because the Andrys patent does not disclose or suggest the inventions of independent claims 12 and 22 for all three of these reasons, independent claims 12 and 22 are not unpatentable over the Andrys patent.

Because independent claim 12 is not unpatentable over the Andrys patent, dependent claims 14 and 15 are likewise not unpatentable over the Andrys patent.

**CONCLUSION**

In view of the above, it is clear that the claims of the present application are patentable over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

Respectfully submitted,

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